Injuries Among Older Americans With and Without Medicare

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Objectives. We evaluated the generalizability of Medicare fee-for-service data for patients hospitalized with injuries.

Methods. We used 1998–2000 Medicare hospitalization data and National Hospital Discharge Survey (NHDS) data to analyze patients aged 65 years and older with principal injury diagnoses.

Results. Demographics and injury patterns were similar in Medicare data and NHDS Medicare data. Injured patients without Medicare or health maintenance organization coverage were younger, less likely to have hip fractures, and more likely to have head or chest injuries. Mortality and discharge to long-term care were not significantly affected by insurance coverage, after we controlled for injury type and severity, age, gender, and comorbidity. Medicare patients had slightly longer hospital lengths of stay.

Conclusions. Hospital outcomes are generally similar among older patients with a given anatomic injury, regardless of insurance coverage. (*Am J Public Health.* 2005;95:273–278. doi: 10.2105/AJPH.2003.036871)

Among patients admitted to American hospitals after injury, older persons have become the dominant group, a trend that is likely to continue as the population ages.[1] For these patients, Medicare fee-for-service data are a promising resource for injury research, because they include a large proportion of the population aged 65 years and older; are available in the same format for all states; and allow linkage of encounters before, during, and after an index hospitalization.

Samples of Medicare hospitalization data have been used for general descriptions of injury epidemiology and cost[2] and specifically to study the incidence of common fractures.[3,4] Several groups have studied geographic variation in the incidence of fractures of the femoral neck (hip), with conflicting explanations of this variation.[5–7] Such studies rely on the assumption that the number of Medicare claims for hospital treatment of a fracture represents the incidence of such fractures in the general population.

Research using Medicare data to determine the outcomes of hospital care for injured patients has also begun to appear. Gubler et al.[8,9] linked Medicare hospital data to subsequent encounters and mortality to measure recurrence and long-term survival after hospitalization for injury in the state of Washington. Rzepka et al.[10] used Medicare data to compare outcomes of injured patients in various hospitals nationwide, controlling for age, gender, and race, but paradoxically reported an increased mortality in specialized trauma centers.

There are well-described limitations in the analysis of hospital discharge data in general[11] and Medicare data in particular.[12] Although most Americans aged 65 years and older are enrolled in Medicare, differences in coverage by age and race have been reported in the past.[12] Furthermore, a significant number of Medicare enrollees also participate in managed care plans and therefore may not submit Medicare claims; this proportion varies by region and tends to be greatest in urban areas.[13] Because of the known differences in the incidence of different kinds of injuries by age, race, and residence, we wanted to determine whether it was reasonable to generalize results from fee-for-service Medicare data to the older population as a whole. Furthermore, any differences in outcomes for the population not insured by Medicare might suggest areas in which trauma care systems require improvement or additional resources.

METHODS

Medicare Provider Analysis and Review (MedPAR), inpatient, and denominator files for 1998–2000 were obtained from the Centers for Medicare and Medicaid Services through a cooperative agreement with the Center for Evaluative Clinical Sciences at Dartmouth Medical School.

The Medicare denominator file contained data on all Medicare beneficiaries, combining entitlement status information from the Social Security Administration and managed care enrollment information for Medicare beneficiaries. The file also contained a unique patient identifier, basic demographic data, and date of death. The denominator file was used to identify the number of Medicare beneficiaries aged 65 and older who were entitled to hospital insurance benefits (part A) as of July 1, 1999, and who resided in 1 of the 50 states or the District of Columbia. We created a fee-for-service subgroup of part A beneficiaries by excluding any beneficiary enrolled in a managed care plan on July 1, 1999. This subgroup defined a midyear population that could have had injury hospitalization claims in the MedPAR file. We compared this subgroup with census estimates of the 1999 population aged 65 and older and used it as the denominator for subsequent rate calculations. Population estimates for US residents aged 65 and older were obtained from the US Census Bureau for July 1, 1999, by age and state (including the District of Columbia).[14]

The MedPAR file contained hospital discharge abstracts summarizing acute care inpatient stays for fee-for-service beneficiaries of Medicare hospitalization insurance. Records for each discharge contained hospital utilization and outcome data, with up to 10 *International Classification of Diseases, Ninth Revision, Clinical Modification* (*ICD-9-CM*)[15] discharge diagnoses, possibly including 1 or more E-codes. Although repeated hospitalizations for the same person could be identified, each admission was considered a separate case in this analysis. Cases were selected from MedPAR if the principal *ICD-9-CM* admitting diagnosis was in the range 800–959 (injuries), excluding 905–909 (late effects of injury), 930–939 (foreign bodies), or 958 (complications of injury). Age at injury was computed from admission date in the MedPAR file and birth date in the denominator file. Injury records without a corresponding denominator record (less than 0.1%) were deleted.

Injuries were stratified into 6 frequently occurring groups: fractures of the femoral neck (hip), other extremity injuries, spine injuries, head injuries, chest injuries, and other injuries. "Hip fracture" cases were considered to be those with a principal *ICD-9-CM* diagnosis code of 820.[15] The "other extremity injury" group included patients with principal *ICD-9-CM* diagnosis codes 808 (pelvic fractures), 810–819 (upper extremity fractures), 821–829 (lower extremity fractures other than hip fractures), 831–838 (dislocations), 840–845 (sprains and strains), 880–897 (wounds), 912–917 (superficial injuries), 923–924 (contusions), or 927–928 (crush injuries).[15] "Spine injuries" were defined as those with principal *ICD-9-CM* diagnosis codes 805–806 or 952.[15] "Head injuries" were defined as those with principal *ICD-9-CM* diagnosis codes 800–804 or 850–854.[15] "Chest injuries" were defined as those with principal *ICD-9-CM* diagnosis codes 807, 860–862, 875, or 901.[15] The "other injury" category contained a variety of less common injuries, including abdominal injuries, burns, superficial wounds, and so forth.

Commercially available software (ICDMAP-90; Tri-Analytics, Baltimore, Md) was used to map each diagnosis code to 1 of 6 body regions and 6 levels of Abbreviated Injury Score (AIS) when possible and then calculate the maximal AIS in each body region and the maximal AIS overall.[16] The injury resulting in overall maximal AIS for a given patient was usually, but not necessarily, the principal diagnosis. We used the "ignore unknown" and "low severities" options for the software, thus ignoring any *ICD-9-CM* code that could not be classified and selecting the less severe AIS when this mapping was equivocal. AIS is intended to classify the severity of injuries based on clinical experience (1=minor; 2=moderate; 3=severe, not life-threatening; 4=severe, life-threatening, survival probable; 5=critical, survival uncertain; >5=fatal).[17]

Diagnosis codes potentially relating to preexisting medical conditions were identified according to the inclusion criteria of Charlson et al.,[18] with the Dartmouth/Manitoba modifications described by Romano et al.[19] The Charlson score adds weights of 6 for the presence of AIDS or metastatic solid tumor; 3 for severe liver disease; 2 for any malignancy, renal failure, or complications of diabetes; and 1 for a history of myocardial infarction, peripheral vascular disease, dementia, chronic lung disease, rheumatic disease, mild liver disease, or uncomplicated diabetes.

In order to evaluate whether the fee-for-service Medicare population was similar to the general population of patients aged 65 and older hospitalized after injuries, independent estimates of hospital utilization were obtained from public use files of the National Hospital Discharge Survey (NHDS) for the years 1998–2000. NHDS is a national probability sample of discharge data from acute care general hospitals in the United States conducted annually by the Centers for Disease Control and Prevention. NHDS records a patient's age and gender, up to 7 *ICD-9-CM* diagnosis codes, expected primary and secondary reimbursement source, and hospital outcomes including discharge destination and length of stay (LOS).

We selected and classified NHDS patients using the same criteria described earlier for the Medicare claims files. Among these, we distinguished patients for which "HMO/PPO" (health maintenance organization/preferred provider organization) was listed as either the primary or secondary expected reimbursement source (subsequently referred to as "NHDS HMO" patients [some of whom may have *both* HMO and Medicare]) and non-HMO patients for which Medicare was listed as either the primary or secondary expected reimbursement source (subsequently referred to as "NHDS Medicare" patients); the remaining patients (subsequently referred to as "NHDS Other" patients) had no mention of either HMO or Medicare as an expected reimbursement source. We analyzed NHDS data with Stata version 7 (Stata Corp, College Station, Tex) with methods designed for weighted survey data (procedures svytotal, svymean, svyprop, svylogit, etc.). We obtained estimates of national totals or proportions by weighting according to the inverse of the case selection probability.[20]

Because of the interrelations of hospital mortality, LOS, and discharge to long-term care, we determined the effect of Medicare and HMO status on these outcomes with regression models modified for the use of survey data,[21] controlling simultaneously for the potential confounding factors of age group (65–69 years, 70–74 years, 75–79 years, 80–84 years, 85 years and older), gender, injury categories, comorbidity (Charlson score 0, 1, 2, and greater), and maximal AIS (0–2, 3, 4–6). NHDS data do not designate the primary sampling units for each case, so that the confidence intervals reported by Stata should be conservative.[21,22]

RESULTS

Characteristics of the US population aged 65 years and older with respect to entitlement in the Medicare program are given in Table 1. In 1999, 96% of the estimated total population aged 65 and older was enrolled in some part of Medicare, and 95% was eligible for part A (hospital) benefits. However, some beneficiaries participated in managed care programs, so that only 77% of this estimated population would have been eligible to submit a fee-for-service claim in case of injury (or other illness). Age and gender distributions for all classifications of Medicare enrollments were similar to the age and gender distributions estimated by the census; racial distribution was also similar across classifications except that there was a larger percentage in the "Other" category among Medicare enrollees than in the census estimates.

Nineteen percent of the part A–entitled Medicare population aged 65 and older was enrolled in managed care on July 1, 1999. The western states contained 19.8% of the total population aged 65 and older, but only 14.9% of the Medicare fee-for-service population as a result of more frequent participation in managed care programs. The 2 states with the highest proportions of the Medicare population enrolled in managed care were California (44%) and Arizona (41%). States with the largest populations of senior citizens generally had substantial proportions enrolled in managed care programs.

TABLE 1—Characteristics of the US Population Aged 65 and Older and of Those Enrolled in Medicare: July 1, 1999[a]

	Census Estimate, %	Enrolled in Any Part of Medicare, %	Eligible Part A, %	Fee for Service, %
Total, thousands	34540	33315	32906	26426
Age, y				
65–69	27.4	26.9	27.0	26.3
70–74	25.4	25.6	25.6	25.3
75–79	21.2	21.3	21.3	21.2
80–84	13.9	14.0	14.0	14.3
≥85	12.1	12.3	12.2	13.0
Gender				
Female	58.6	59.0	58.9	59.2
Male	41.4	41.0	41.1	40.8
Race				
White	88.9	86.8	87.3	87.8
Black	8.3	7.9	7.8	7.8
Other	2.8	5.3	4.9	4.4
Region				
Northeast	21.1	21.3	21.1	20.3
Midwest	23.6	24.2	24.3	27.1
South	35.5	35.0	35.2	37.7
West	19.8	19.6	19.3	14.9

[a]Percentages were calculated from the actual totals, which were rounded to the nearest thousand for this table.

TABLE 2—Average Annual Total and Distribution of Hospital Discharges With a Principal Injury Diagnosis, as Estimated by NHDS for 1998–2000

	MedPAR[a]	NHDS Medicare[b] (95% CI)	NHDS HMO[b] (95% CI)	NHDS Other[b] (95% CI)
Total, thousands	486.2	547 (533, 562)	46 (41, 50)	65 (60, 71)
Principal diagnosis, %				
Hip fractures	46.2	45.4 (43.9, 46.9)	48.0 (43.2, 52.8)	33.0 (28.9, 37.1)
Other extremity injury	30.9	31.4 (30.0, 32.8)	27.8 (23.4, 32.2)	34.0 (29.9, 38.1)
Spine injury	5.5	5.9 (5.2, 6.6)	3.9 (1.6, 6.2)	5.9 (3.7, 8.1)
Head injury	7.1	6.2 (5.5, 6.9)	8.4 (5.9, 10.9)	9.7 (7.5, 11.9)
Chest injury	4.1	4.1 (3.5, 4.7)	3.7 (1.9, 5.6)	8.2 (5.9, 10.5)
Other injury	6.2	7.1 (6.3, 7.9)	8.1 (5.5, 10.7)	9.2 (6.7, 11.7)

Note. MedPAR = Medicare Provider Analysis and Review; NHDS = National Hospital Discharge Survey; HMO = health maintenance organization; CI = confidence intervals.
[a]MedPAR percentages have been calculated from the actual fee-for-service totals.
[b]NHDS percentages are weighted estimates.

The 1998–2000 MedPAR files contained 1 458 675 injury discharges for patients aged 65 and older (Table 2 shows annual averages), of which 135 596 resulted from repeat hospitalizations of the same person. The number of NHDS Medicare patients aged 65 and older admitted in 1998–2000 with injuries was estimated at 1 642 000 (95% confidence interval [CI]=1 599 000, 1 685 000), the number of NHDS HMO patients was about 137 000 (95% CI=124 000, 150 000), and the estimated number with neither Medicare nor an HMO was about 196 000 (95% CI=180 000, 212 000). Thus, of the population aged 65 and older admitted with injuries, an estimated 84.1% (95% CI=82.1%, 84.1%) were NHDS Medicare, an estimated 7.0% (95% CI=6.3%, 7.7%) were NHDS HMO, and an estimated 9.9% (95% CI=9.1, 10.7%) had neither Medicare nor HMO coverage.

In MedPAR, 46.2% of the principal diagnoses were hip fractures, and 30.9% were other extremity or pelvic fractures. The distributions of injury categories among NHDS Medicare or NHDS HMO patients were similar to those in MedPAR; NHDS Other were less likely to have a hip fracture and more likely to have head, chest, or "other" injuries (Table 2).

After our simple stratification by anatomic location of injury, MedPAR demographic and outcome data were already fairly similar to the survey estimates for NHDS Medicare or NHDS HMO patients (Table 3). For each injury type, NHDS Other patients tended to be younger. Mean hospital LOS was remarkably similar regardless of injury type or insurance coverage. A substantial proportion of patients were discharged to long-term care facilities, including about half the patients with hip fractures. Head injuries had a much higher mortality than any other category, regardless of insurance status.

Using logistic regression, modified for the survey design, and controlling for age group, gender, comorbidity, and maximal AIS, in addition to injury categories, we found the effects of Medicare or HMO status on hospital mortality or discharge of survivors to long-term care to be insignificant ($P>.05$). When we controlled for the same factors, linear regression of the logarithm of LOS among survivors showed small but significant effects for Medicare or HMO coverage; after exponentiation of the model coefficient, predicted LOS compared with that of the NHDS Medicare patients was decreased by a factor of 0.89 (95% CI=0.83, 0.96) in NHDS HMO patients and by a factor of 0.88 (95% CI=0.82, 0.95) in NHDS Other patients.

DISCUSSION

Injuries are a common cause of mortality in the older population,[23] and the frequency of hospitalization after injuries among the popu-

TABLE 3—Characteristics of Injured Patients With or Without Medicare Coverage as Reported by NHDS for 1998–2000, Categorized by Principal Diagnosis[a]

	MedPAR	NHDS Medicare	NHDS HMO	NHDS Other
Hip fracture				
Mean age, y	83.3	82.8 (82.5, 83.2)	81.9 (80.9, 82.9)	80.7 (79.3, 82.1)
Female, %	76.9	76.7 (74.7, 78.6)	72.2 (65.8, 78.7)	75.2 (68.9, 81.6)
Died in hospital, %	3.3	2.7 (1.9, 3.5)	1.3 (0.0, 2.7)	3.2 (0.3, 6.1)
Discharged to LTC, %	55.9	52.4 (50.2, 54.7)	56.9 (50.2, 63.7)	47.3 (39.7, 54.8)
Mean hospital LOS, d	6.4	6.9 (6.7, 7.2)	6.5 (5.6 , 7.4)	6.9 (5.8, 7.9)
Other extremity injury				
Mean age, y	80.0	79.8 (79.3, 80.2)	77.1 (75.8, 78.3)	76.2 (75.0, 77.3)
Female, %	78.1	77.2 (74.9, 79.5)	71.3 (62.9, 79.6)	71.6 (65.2, 77.9)
Died in hospital, %	1.3	1.2 (0.4, 1.9)	1.7 (0.0, 3.9)	1.6 (0.0, 3.3)
Discharged to LTC, %	37.7	35.7 (33.1, 38.3)	34.9 (26.4, 43.5)	25.9 (19.8, 32.1)
Mean hospital LOS, d	4.8	5.7 (5.0, 6.3)	4.5 (3.9, 5.1)	4.7 (4.0, 5.3)
Spine injury				
Mean age, y	81.2	80.7 (79.9, 81.6)	76.0 (71.1, 80.8)	79.4 (76.2, 82.6)
Female, %	69.6	70.5 (64.6, 76.4)	64.4 (36.2, 92.6)	67.5 (51.9, 83.0)
Died in hospital, %	3.1	1.7 (0.1, 3.3)	0.0 (0.0, 0.0)	0.4 (0.0, 1.3)
Discharged to LTC, %	37.0	36.0 (30.2, 41.7)	20.0 (0.0, 43.7)	42.1 (21.6, 62.6)
Mean hospital LOS, d	6.2	6.6 (5.8, 7.4)	7.0 (4.6, 9.2)	8.5 (5.2, 11.8)
Head injury				
Mean age, y	80.4	80.0 (79.2, 80.9)	80.0 (77.4, 82.5)	75.9 (74.2, 77.6)
Female, %	55.2	59.7 (54.3, 65.2)	55.9 (40.7, 71.2)	55.1 (44.0, 66.2)
Died in hospital, %	13.2	13.1 (9.2, 17.0)	10.6 (0.5, 20.8)	14.3 (6.8, 21.8)
Discharged to LTC, %	25.1	23.5 (19.1, 27.9)	12.5 (1.5, 23.5)	19.6 (12.1, 27.2)
Mean hospital LOS, d	7.0	6.9 (6.1, 7.7)	6.3 (4.0, 8.6)	6.3 (4.7, 7.9)
Chest injury				
Mean age, y	80.4	79.3 (77.9, 80.8)	79.5 (75.9, 83.2)	76.8 (74.9, 78.8)
Female, %	57.8	59.3 (51.6, 67.0)	60.9 (37.8, 84.1)	50.7 (36.4, 65.1)
Died in hospital, %	4.5	6.8 (2.5, 11.1)	2.2 (0.0, 6.1)	7.3 (0.8, 13.7)
Discharged to LTC, %	27.0	23.2 (16.9, 29.5)	18.4 (2.6, 34.4)	17.2 (7.0, 27.4)
Mean hospital LOS, d	6.5	6.9 (5.7, 8.1)	4.0 (2.9, 5.2)	5.6 (3.5, 7.6)
Other injury				
Mean age, y	80.3	79.1 (78.0, 80.1)	76.7 (74.4, 79.2)	75.9 (74.2, 77.7)
Female, %	62.2	60.3 (54.4, 66.1)	54.3 (38.0, 70.5)	55.5 (42.0, 68.9)
Died in hospital, %	3.6	2.4 (0.7, 4.1)	3.9 (0.0, 9.2)	5.8 (0.2, 11.4)
Discharged to LTC, %	23.7	24.9 (19.9, 29.9)	23.6 (10.3, 36.9)	19.1 (3.8, 34.4)
Mean hospital LOS, d	5.3	5.3 (4.1, 6.4)	4.2 (2.8, 5.5)	5.0 (3.9, 6.1)

Note. MedPAR = Medicare Provider Analysis and Review; NHDS = National Hospital Discharge Survey; HMO = health maintenance organization; LTC = long-term care; LOS = length of stay.
[a]Corresponding MedPAR percentages and means have been calculated from the actual totals. NHDS percentages and means are weighted estimates, with 95% confidence intervals given in parentheses. LTC indicates discharges to long-term care (or discharges to a skilled nursing facility in MedPAR).

lation aged 65 and older has been clearly demonstrated using data from Medicare[2] or NHDS.[24] Prevention of injury in this population is obviously most valuable, but reduction in mortality and the cost of care once an injury has occurred are also important goals. Further studies using Medicare data to evaluate the effectiveness and efficiency of trauma care systems should be anticipated, but it is important to consider potential limitations in the interpretation of such studies.

Previous studies have found that injury identification using Medicare claims data is less than perfect. Fisher et al.[12] found that 9% of apparent hip fracture cases had a procedure code indicating surgery for fracture fixation but no diagnosis code indicating a hip fracture. Ray et al.[3] also found that the identification of fractures other than hip fractures in Medicare data was also more sensitive if procedure codes as well as diagnosis codes were used. Other injuries, even other fractures, may be more difficult to identify because their management does not necessarily require a specific billable procedure.

Although more than 95% of Americans aged 65 and older are eligible for Medicare part A (hospital) benefits, differences in coverage by age and race have been reported.[12] The Census Bureau and Medicare use different classification systems for race: the former classifies all races as either Hispanic or Non-Hispanic, whereas the latter has mutually exclusive categories for Black, White, Hispanic, Asian, and so forth, so the Medicare Hispanic category contains unknown proportions of both Blacks and Whites. Thus, the Black, White, and Other designations in Table 1 do not measure exactly the same groups as the census. However, we found no evidence that the Medicare data represented any racial population disproportionately. NHDS data on race are frequently missing, so results from this database cannot be assessed.

Medicare claims data represent a large but still selected population. American citizens become entitled to Medicare benefits at their 65th birthday if they or their spouse have paid Social Security taxes for at least 39 quarter years. Some of the poorest citizens are thus not eligible for benefits. Even for persons who are eligible for Medicare, managed care programs have become more common, so that more than 20% of Medicare beneficiaries do not bill Medicare directly for services. The proportion retaining fee-for-service coverage varies substantially by geographic region (Table 1). By definition, subjects will not appear as incident cases in MedPAR unless they generate a Medicare bill for medical services.

The number of hospital discharges after injury identified in the MedPAR file was about 74% of the total number of injured patients at least 65 years of age estimated by NHDS; this was approximately the same as the proportion of the entire population covered by fee-for-service Medicare (77%). However, there may be some misclassification by insurance categories in NHDS: The estimated number of injured patients in NHDS data recorded as "Medicare" is larger than the number of injured fee-for-service patients in MedPAR. This suggests that the former group also includes some of the Medicare population covered by managed care; it is also probable that some of the HMO patients for whom Medicare was not given as a primary or secondary expected source of payment actually did have coverage. Previous studies have found that "Medicare beneficiaries have difficulty articulating the type of insurance they have, and some do not even know if they or their spouse have insurance."[25(p976)]

Despite this limitation, the similarity between MedPAR and NHDS Medicare populations admitted with injuries, after only a simple stratification by injury type, suggests that the latter patients are a reasonable representation of the fee-for-service group. Hypotheses about potential misclassification might be tested with data from a large state with substantial Medicare HMO coverage, such as California.[25] NHDS data alone are insufficient to answer this question, because they do not have further details about the type of insurance and do not identify the geographic location of hospitals except by general region. These considerations also make it impossible for this study to estimate rates of injury or hospitalization in the population not covered by fee-for-service Medicare.

Hip fractures alone constituted nearly half the Medicare cases of injury and therefore dominate any analysis of injury in older people; this category would best be considered separately from other injuries. Our data suggest that hip fractures are more frequent in the Medicare population because of older age, but that the hospital outcomes are similar for a similar age, regardless of insurance coverage. The "other extremity injury" category contained more than half the remaining patients and likewise demonstrated no major differences between Medicare, HMO, and other patients in the NHDS data. Spine injuries (mostly involving osteoporotic bone without damage to the spinal cord) were another group of significant size. Any differences in outcome for patients not covered by fee-for-service Medicare would be most important when attempting to generalize findings for more serious injuries, because approximately 14% (95% CI=11%, 17%) of the head injury patients and 18% (95% CI=13%, 23%) of the chest injury patients aged 65 and older were in the NHDS Other group.

The finding of a modest reduction in acute hospital LOS for surviving patients in the NHDS HMO or NHDS Other groups, after we controlled for multiple other factors, is of some interest but needs to be tempered by the possibility of misclassification described earlier, as well as recognition that an increasing number of injured patients are discharged to skilled nursing facilities.[1] NHDS (like most hospital discharge data sets) does not give details about mortality and institutional resource use after discharge from an acute care hospital. NHDS data do not specify whether "long-term care" is the same as skilled nursing facility placement, but the close agreement between the MedPAR and NHDS Medicare data suggests that they are the same. Age, gender, LOS, long-term care, and in-hospital mortality are interrelated, so that definitive conclusions cannot be made about the differences in outcomes between Medicare, HMO, and other patients from the NHDS data alone.

Medicare data have many of the same limitations as other hospital discharge data, but some of these limitations are mitigated by the ability to track patients over time and construct episodes of care using inpatient, outpatient, and skilled nursing facility records. The high proportion of the population aged 65 and older enrolled in Medicare allows national analyses, and generalization of properly stratified analyses to the general population of older US citizens is reasonable, with the possible exceptions mentioned earlier. However, for certain less frequent but often severe categories of injury, the noncovered population constitutes a significant minority, which may have characteristics and outcomes different from those seen in Medicare data. These considerations are important in the evaluation of trauma care systems, which have a particular focus on the most severely injured patients.

NHDS is a convenient reference database because it is freely available to all researchers and collects data in a uniform manner from hospitals representing the entire United States. Because NHDS is a probability sample, our study also is limited by the analytic problems and imprecision inherent in the use of survey data, especially when infrequent injuries are of interest. Further evaluation of the older population not covered by Medicare might employ data from a large state or the multiple-state samples developed by the Agency for Healthcare Research and Quality.[26–28] However, these lack some of the advantages of Medicare data described earlier. Multiple approaches will be necessary to determine effective methods to reduce the growing incidence and cost of injuries in this particularly vulnerable population. ■

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Contributors

D.E. Clark directed the study, analyzed the NHDS data, and wrote the article. M.A. DeLorenzo analyzed the Medicare data. F.L. Lucas assisted with Medicare data analysis. F.L. Lucas and D.E. Wennberg assisted with study design. All authors reviewed multiple drafts of the article.

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Human Participant Protection

Institutional review boards at Maine Medical Center and the Harvard School of Public Health judged this study to be exempt from review. This article was also reviewed by the Centers for Medicare and Medicaid Services.

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